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Report to Sen. Warren G. Magnuson, Chairman, Senate Committee on Commerce; Sen. James B. Pearson, Ranking Minority Member; by Elmer B. Staats, Comptroller General.

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A review of the Coast Guard's procurement program for medium range surveillance (MRS) aircraft covered mission requirements, specifications for procurement established by the Coast Guard in its request for proposals, and the Coast Guard's decision to limit its procurement to a single type of aircraft. Findings/Conclusions: The missions to be accomplished by the new aircraft are similar to missions that have been performed by aircraft now in the Coast Guard inventory. These missions include: search and rescue operations, marine environmental protection operations, enforcement of laws and treaties by conducting surveillance patrols, marine scientific activities including tracking and icebergs, and miscellaneous missions such as port safety and security patrols and searches. Procurement of a single type of aircraft to perform missions is preferable because training of personnel, repair parts requirements, and maintenance programs are accomplished more efficiently and economically for one type rather than for two or more types of aircraft. Also, the use of several different types of aircraft would mean that some would not have a full multimission capability. A detailed technical specification contained requirements for the MRS aircraft including a requirement that the cabin/cockpit volume be at least 600 cubic feet. The requirement for a minimum cabin volume of 600 cubic feet appeared to be reasonable. (Author/HTW)

COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON, D.C. 20548



JAN 17 1977

04397

B-114851

The Honorable Warren G. Magnuson, Chairman
The Honorable James B. Pearson, Ranking
Minority Member
Committee on Commerce
United States Senate

Your September 9, 1976, letter requested that we review the Coast Guard's procurement program for medium range surveillance aircraft. You requested specifically that we (1) review the mission requirements assigned to the medium range surveillance aircraft, (2) test the mission requirements against the specifications for the medium range surveillance procurement established by the Coast Guard in its request for technical proposals, and (3) render an opinion on the Coast Guard decision to limit its procurement to a single type of large medium range surveillance aircraft with a cabin volume of at least 600 cubic feet.

The missions to be accomplished by the new aircraft are well documented and are similar to missions that have been performed for a number of years by aircraft now in the Coast Guard inventory. The primary missions, accounting for 85 percent of anticipated flight time, are search and rescue, marine environmental protection, and law enforcement.

We believe that procurement of a single type of aircraft to perform missions is preferable because training of personnel, repair parts requirements, and maintenance programs are accomplished more efficiently and economically for one type rather than for two or more types of aircraft. Also, the use of several different types of aircraft would mean that some would not have a full multimission capability. With a relatively small fleet (41 aircraft) there could be serious scheduling and positioning problems because the aircraft would be dispersed at a number of locations and some would be in maintenance and overhaul facilities.

PSAD-77-63

The key question to be resolved concerning this procurement was the size of the cabin. In our opinion, the Coast Guard's requirement for an aircraft with a minimum cabin volume of 600 cubic feet appears reasonable. Based on drawings and equipment brochures for certain equipment on board, and judgments of Air Force, Navy, and manufacturers' representatives for other items, we established that a cabin with somewhere between 550 and 650 cubic feet was required.

We discussed our report informally with Coast Guard officials who agreed with its thrust.

Specific data on mission requirements, technical specifications, and our analysis of cabin volume requirements are attached. We will be happy to discuss this data with you if desired.



Comptroller General
of the United States

Enclosures - 2

COAST GUARD PROCUREMENT OF
MEDIUM RANGE SURVEILLANCE AIRCRAFT

BACKGROUND

Since 1973 the Coast Guard has attempted to purchase a fan jet aircraft to replace its aging medium range surveillance Albatross fleet. The Coast Guard plans to use the new aircraft for 20 to 30 years. Originally the Coast Guard attempted to purchase 41 Rockwell Sabre 75-A aircraft on a sole source basis. However, because of congressional concern over the absence of competition for the award, the Coast Guard decided to use the formally advertised competitive two-step procurement method. Under step one, the Coast Guard solicited technical proposals from aircraft manufacturers on the basis of operational and engineering requirements. During this step five aircraft manufacturers submitted technical proposals and all were judged acceptable. All proposed aircraft had cabins of at least 600 cubic feet. Under step two, the Coast Guard solicited firm fixed price proposals and three of the five firms responded by the procurement closing date of October 28, 1976. The Falcon Jet Corporation submitted the lowest bid of \$4.995 million each for its Falcon 20-G aircraft. The Coast Guard plans to award a firm fixed price with escalation contract for 41 aircraft by the bid expiration date of January 26, 1977.

MISSION REQUIREMENTS

The new medium range surveillance (MRS) aircraft will be a multimission aircraft, as is the Albatross. The missions will include the following:

- Search and rescue (SAR) operations which aid persons and property in distress.
- Marine environmental protection (MEP) operations designed to minimize damage to the marine environment caused by intentional or unintentional acts of man, such as oil spills from ships.
- Enforcement of laws and treaties by conducting surveillance patrols (ELT). Although Coast Guard enforcement and surveillance patrols are mainly concerned with protection against unauthorized foreign fishing within U.S. waters,

other law enforcement activity includes prevention of illegal entry of drugs and aliens into the United States and protection of U.S. property.

--Marine science activities which include tracking icebergs in the North Atlantic Ocean and Air-borne Radiation Thermometer Surveys to measure water temperatures on the Atlantic and Pacific coasts.

--Other miscellaneous missions, such as port safety and security patrols and searches, transporting litter-borne patients, and checks of navigation aids such as buoys, lights, and radio beacons.

The Coast Guard's latest approved Aviation Plan, dated April 4, 1975, indicated that the MRS aircraft's primary missions will be SAR, MEP, and ELT operations. According to the plan, about 85 percent of the total MRS's operational flight-hours will be devoted to these three missions by fiscal year 1986.

MRS TECHNICAL SPECIFICATIONS

The Coast Guard prepared a detailed technical specification containing the requirements for the MRS aircraft for the first step of the two-step procurement approach. An important characteristic of the new aircraft was a requirement that the cabin/cockpit volume be at least 600 cubic feet. The Albatross aircraft has a cabin/cockpit volume of approximately 1,200 cubic feet. The specification noted that 600 cubic feet was necessary to carry the crew and equipment needed to perform the MRS aircraft's missions. The 600-cubic-foot requirement was broken down as follows:

- 75 cubic feet for a sensor surveillance console.
- 72 cubic feet for communications and navigation (avionics) equipment.
- 15 cubic feet for a forward looking radar.
- 19 cubic feet of storage space for air droppable equipment, such as dewatering pumps, liferafts, etc.

- 15 cubic feet of storage space for crew survival equipment, such as radios and parachutes.
- 150 cubic feet for three crew positions including a sensor surveillance console operator and two scanners.
- 254 cubic feet for cockpit, aisle, headroom, and additional space to allow for crew movement.

Because some questions were raised on the Coast Guard's need for 600 cubic feet in the MRS aircraft, the Secretary of Transportation requested a detailed itemized list of the volume requirements. On November 19, 1976, the Coast Guard provided the Secretary with a list totaling 616 cubic feet. The following is a comparison of the Coast Guard's list with the volume requirements included in the technical specification.

<u>Item</u>	<u>Cubic feet required</u>	
	<u>Per technical proposal</u>	<u>Per Nov. 19, 1976, listing</u>
Sensor surveillance console	75	75
Avionics	72	65
Forward-looking radar	15	15
Droppable equipment	19	14
Crew survival equipment	15	47
Three crew positions	150	150
Remaining space	<u>254</u>	<u>250</u>
Total	<u>600</u>	<u>616</u>

ANALYSIS OF CABIN VOLUME REQUIREMENT

We reviewed the November 19, 1976, listing to determine if the Coast Guard's 600-cubic-foot requirement was reasonable. We verified some items by reviewing brochures and other documents. Many of the items included in the cabin/cockpit volume requirement involved judgment and were not readily verifiable to documents. In these cases we contacted Government agency and private industry officials to determine if the Coast Guard's estimates were reasonable.

The results of our review of the items in the 616-cubic-foot cabin requirement follow.

Sensor surveillance console--75 cubic feet

The MRS aircraft technical specification showed that the aircraft would carry a remote sensor system with a console occupying 75 cubic feet of cabin/cockpit volume. The sensor system, Aireye, will consist of several sensing devices, integrated to perform reliably under varying environmental conditions. Major Aireye subsystems will include a side-looking airborne radar, a dual frequency line scanner, an aerial reconnaissance camera, and an active-gated television. Although the primary purpose of the sensor system will be oil spill detection, it will also aid the SAK and ELT missions.

The Coast Guard is still developing the Aireye system, and the 75 cubic feet for the sensor console represents the development goal. The Coast Guard has an earlier development model of the sensor system installed on a C-130 aircraft; its sensor console volume is over 100 cubic feet.

Although the Coast Guard made provisions in the technical specifications for installing a sensor package on each MRS aircraft, the Coast Guard has not decided whether or not sensor systems will be procured for each aircraft. A major factor for the indecision on the sensor system procurement appears to be its acquisition cost. According to an undated Coast Guard draft acquisition paper, it will cost about \$5.5 million to develop a sensor system prototype and about \$5.2 million each to procure five additional systems for a total cost of \$31.5 million. The Coast Guard's Commandant told us that he will probably approve the procurement of six sensor systems, including the prototype, but that because of the major cost involved and rapidly developing technology in this field, the number of additional sensor systems to be procured is questionable. In any event, each of the MRS aircraft will be wired to accept a sensor package, and the sensor system is being designed so that it can be easily transferred from one aircraft to another.

We looked into the possibility of the Coast Guard using a sensor package now operating aboard a Custom Service aerial interdiction aircraft instead of the Aireye system. The Customs system uses a navigational forward-looking airborne

radar rather than a side-looking radar and a forward-looking infrared device instead of a line scanner. The Customs system does not use an aerial reconnaissance camera or an active-gated television.

Coast Guard officials did not analyze the Customs Service sensor system in depth, but had Aerojet Electrosystems Company evaluate several alternative system components. The contractor concluded that the forward-looking infrared system would not satisfactorily perform the functions of the line scanner; e.g., it could not reliably identify and record ship names in darkness. Coast Guard officials also told us that the Customs forward-looking radar cannot perform as reliably as the side-looking radar in detecting and mapping oil spills.

The Naval Air Development Center (NADC) helped develop both the Customs Service and Aireye sensor systems. According to an NADC official, the Customs system will not adequately meet the MRS mission requirements because it lacks the data annotation capability needed to successfully prosecute vessels violating marine environmental laws. He also told us that the Customs forward-looking radar costs and weighs more than the proposed MRS forward-looking radar.

Avionics--65 cubic feet

The cover letter transmitting the Coast Guard's current MRS aircraft cabin/cockpit volume requirements to the Secretary of Transportation noted that the volume required for avionics equipment decreased from 72 cubic feet set forth in the technical specification to 65 cubic feet. The decrease was attributed to advanced technologies resulting in smaller equipment. We verified 17 cubic feet of their reported actual equipment by checking manufacturers' equipment brochures. However, the remaining space (about 72 percent) was for wiring, racking, working space, etc., and was a Coast Guard estimate with no documentary support.

Most of the individuals we contacted agreed some additional space was needed for cooling, working space, wiring, etc., but their estimates varied from 25 to 66 percent. Other officials said they could not determine how much space would be needed without detailed information on types of equipment, location in aircraft, size and shape of the space, etc.

We also looked into the possibility of installing some of the avionics equipment outside the cabin in portions of the aircraft lacking temperature and pressure controls, such as the nose or tail, and we discussed this with officials of Collins Radio, Cessna, Lockheed, NARCO Avionics, and the Navy. Most of the officials agreed that some equipment could be installed outside the cabin, but they also agreed that there would be a sacrifice in reliability by installing the equipment outside the cabin. Therefore, without a detailed analysis comparing the extra maintenance costs of avionics equipment installed outside the cabin to possible saving associated with procuring an aircraft with a slightly smaller cabin/cockpit volume, we could not determine which approach would be most advantageous.

Forward-looking radar--15 cubic feet

We concluded that 12 of the 15 cubic feet for the forward-looking radar the Coast Guard included as part of the cabin/cockpit volume requirement should not be included. According to the Falcon Jet Corporation proposal, all of the radar equipment, except the radar scope and some small items, will be installed in the unpressurized nose of the aircraft. Coast Guard officials said all of the aircraft manufacturers that submitted proposals planned on installing the forward-looking radar in the aircraft's nose.

Droppable and crew survival equipment--61 cubic feet

The current estimate of 61 cubic feet for droppable and crew survival equipment was 27 cubic feet greater than the amount in the technical proposal. The cover letter transmitting the Coast Guard's current cabin/cockpit volume requirements noted that the increase was due to continued definitions of required miscellaneous equipment. We found documentary support for 47 of the 61 cubic feet; however, the current estimate erroneously included 14 cubic feet for equipment which will either be installed outside the cabin/cockpit area or is smaller than what the Coast Guard computed.

Three crew positions--150 cubic feet

The Coast Guard's original and current MRS cube requirements specified 50 cubic feet each for three crew members including two observers and a sensor console operator. The technical specification noted that enough

space was needed to allow for movement and the Coast Guard specified that a swivel seat was necessary for the scanner positions to allow for extended search missions. Coast Guard officials referred to Military Standard 1333 in support of their crew volume requirements. The standard indicated that about 35 cubic feet is desired for a nonswivel pilot seat.

Navy and Air Force officials familiar with air surveillance missions confirmed the Coast Guard's requirement for swivel seats. They noted that, to reduce crew fatigue, both Navy and Air Force aircraft have swivel chairs for their surveillance crews. In addition, Lockheed, an aircraft manufacturer, agreed that the 50 cubic feet represented a reasonable requirement for an observer in a swivel chair.

We also attempted to determine if one of the MRS pilots and/or sensor console operators could serve as an observer, thereby possibly eliminating the need for one crew member. Coast Guard officials offered the following rationale supporting their MRS five-man crew requirement (including the two pilots).

- The pilots cannot be effective observers because they must be fully attentive to flying the aircraft, especially when flying at low altitude and slow airspeed over water and in bad weather. Also, when flying at slow speeds and low altitudes, the aircraft must assume a noseup attitude thereby obscuring the pilots' downward vision.
- The sensor console operator would be fully occupied with scanning the sensors and maintaining communications with the base and would not be useful as a scanner except to periodically relieve the other two scanners. The Coast Guard officials said scanners are efficient for only 20 to 30 minutes at a time and must be relieved.
- The unaided eye can detect certain items which the sensor cannot, such as survivors in the water, wooden hulled ships, and rubber rafts. Therefore, scanners are required in addition to the MRS sensors.
- In addition to their scanner duties, the crew members perform other in-flight duties, such as equipment repair, safety checks, and SAR drops.

Navy and Air Force SAR officials agreed with the Coast Guard position that pilots and copilots are not effective observers and that their full time attention is needed to fly the aircraft, especially at low altitudes and slow speeds over water. They also agreed that scanners are efficient for only short time periods.

Remaining space--250 cubic feet

The current estimate of remaining space includes 100 cubic feet for the cockpit and 150 cubic feet for movement areas. The cockpit space includes 70 cubic feet for the pilot and copilot which, as discussed previously, agrees with Military Standard 1333, and 30 cubic feet for consoles, instruments, panels, etc. We checked the cockpit size of several comparable aircraft and found them to range from 84 to 110 cubic feet.

The 150-cubic-foot movement area includes aisles and walkways, overhead and ceilings, and nonfunctional and passenger space. Based on a military standard, average aisle width of 1-1/2 feet and cabin height of 5-1/4 feet, multiplied by a cabin length of about 20 feet (shortest aircraft cabin with 500 or more cubic feet shown in enc. II) we estimated a firm need of about 150 cubic feet for aisle space. The 150-cubic-foot requirement for movement areas seems conservative since it also includes space for possible passengers and nonfunctional space.

CONCLUSION ON VOLUME REQUIREMENT

In our opinion, the Coast Guard can perform its MRS mission with a cabin volume of somewhere between 550 and 650 cubic feet.

There is a possibility that the Coast Guard could slightly reduce the requirement below 600 cubic feet by allowing less space for crew and avionics. On the other hand, the MRS aircraft is planned to be used by the Coast Guard as a multimission aircraft and it is possible that new missions and/or more efficient search and rescue equipment and techniques will be developed which will require additional space in the aircraft. We believe it is preferable to have some additional space for flexibility and future growth for an aircraft to be used for 20 to 30 years.

MIX OF AIRCRAFT

An assessment of whether the Coast Guard could use a mix of smaller (10,000 to 20,000 pound) and larger (20,000 to 30,000 pound) aircraft would entail a detailed analysis of the Coast Guard's MRS mission, including determining the (1) number of multiple missions flown, (2) number of times initial missions are diverted to handle emergencies, (3) number of flight-hours required by each type of aircraft to accomplish the missions, and (4) cost of additional training, repair parts, and maintenance, etc. We were unable to make this assessment in time to provide you with a timely response to your letter.

However, the Coast Guard has several analyses, which show that a mix of aircraft would result in higher life cycle costs, even though the smaller aircraft's acquisition and operating costs are considerably less than the aircraft the Coast Guard plans to procure. A major reason for the higher life cycle cost is that the Coast Guard's analyses assume the larger aircraft would be equipped with a full sensor system, whereas the smaller aircraft would not. Thus, the larger aircraft could fly wider track spacings thereby reducing the number of flight-hours required and the number of aircraft. As mentioned previously, however, there is a question on how many aircraft will be sensor equipped.

According to one Coast Guard analysis, twice as many smaller aircraft without sensors would be needed to perform the same missions as the larger aircraft with sensors, plus some missions would have to be performed by a long-range C-130 aircraft. A Coast Guard official estimated that, excluding the sensor question, 47 smaller aircraft would be needed instead of 41 larger aircraft. Aircraft manufacturing representatives agreed that more smaller aircraft would be needed although they could not specify the number.

A major reason the Coast Guard has rejected using a mix of aircraft is that they want the MRS to be a multi-mission aircraft capable of being diverted from one mission to another. Coast Guard officials told us that, according to a Coast Guard analysis of fiscal year 1976 flight records from several Coast Guard air stations, about 20 percent of all Albatross SAR missions resulted from diverted aircraft and about 30 percent of the SAR cases were first reached by an aircraft diverted from

a non-SAR mission. We did not verify these figures; however, the computation used by the Coast Guard seemed reasonable.

According to Coast Guard officials, smaller aircraft would have to be dedicated rather than multimission because the smaller aircraft would not be capable of carrying all the crew and equipment needed to perform all missions. For example, the interior volume of the cabins of two smaller aircraft which we examined are less than 300 cubic feet each.

Another major Coast Guard objection to a mix of aircraft is the higher logistics, maintenance, and training costs associated with a mix of aircraft. We agreed that additional cost and logistics problems would occur with an aircraft mix although the amount would be difficult to quantify. We believe that for the relatively small number of MRS aircraft to be procured by the Coast Guard, logistics costs associated with maintaining more than one aircraft type could become very expensive. Also, because of the relatively small size of the proposed MRS fleet, the multimission capability seems advantageous by providing the Coast Guard with more flexibility to perform its MRS missions with a single type of multimission aircraft.

Conclusion on aircraft mix

The small size of this fleet makes a mix of aircraft extremely difficult from a logistics, training, and utilization standpoint. In our opinion, the possible problems resulting from a mixed fleet outweigh the limited procurement cost advantages.

COMMERCIAL AIRCRAFT WITH TURBOFAN OR TURBOJET ENGINESWITH CABIN VOLUME OF 500 TO 2,000 CUBIC FEET EACHLISTED IN "JANE'S ALL THE WORLDS AIRCRAFT 1974-1975"

	Cabin		Range (note a) (miles)	Maximum takeoff weight (pounds)	Engines
	Volume (cubic feet)	Length			
Dassault Mystere 20/Falcon	700	23' 2-3/4"	2,220	28,660	2 Turbofans
Grumman American Gulfstream 71	1,300	33' 11"	3,886	62,000	2 Turbofans
Hawker Siddeley 125/600	628	21' 4"	1,796	25,000	2 Turbojets
Lockheed Jetstar II	850	28' 2-1/2"	3,187	43,750	4 Turbofans
Rockwell Sabre 60	b/app.580	24' 5"	1,992	20,000	2 Turbojets
Rockwell Sabre 75	b/660	24' 5"	1,738	21,000	2 Turbojets
Rockwell Sabre 75A	b/660	24' 5"	1,938	23,000	2 Turbofans
VFW-Fokker VFW 614	1,748	36' 9-1/4"	1,249	43,980	2 Turbofans
Yakovlev Yak 40	c/app.900	23' 2-1/2"	1,118	33,750	3 Turbofans
Cessna Citation III (note d)	app.550	23'	2,760	17,150	2 Turbofans

a/Varies according to passengers and fuel.

b/Data on cabin volume obtained from manufacturer to modify data contained in Jane's.

c/Exact cabin volume not shown. Dimensions are: length--23' 2-1/2"; maximum width--7' 3/4"; and maximum height--6' 3/4".

d/The Cessna Citation III is not shown in Jane's 1974-75 edition. Data was obtained from manufacturer.